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(54) Vehicle monitoring apparatus

(57) Vehicle monitoring apparatus comprises a vehicle detection means (10) to detect the presence of a vehicle and provide a signal under predetermined conditions. Two video cameras (8a, 8b) provide a telephoto image of the vehicle and a wide angle image of the vehicle and its surroundings respectively, in response to the signal. The cameras can be provided in a roadside cabinet (1) and controlled and monitored at a remote monitoring station. This arrangement provides for an image of the number plate of the vehicle together with a wide angle image of the surroundings without requiring the use of a high resolution video camera.

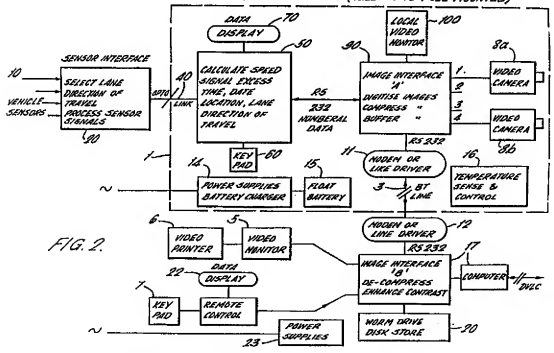

FIG. 2.

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1990.

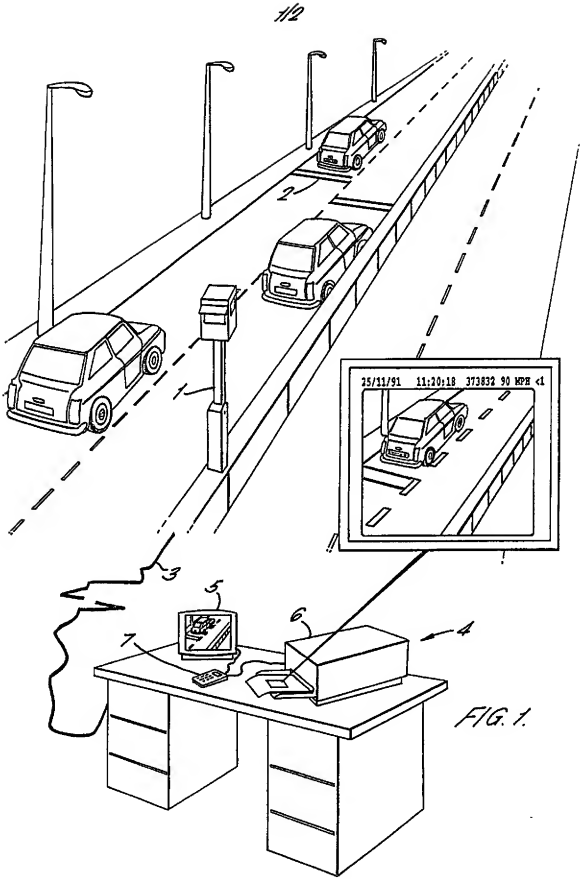

FIG. 1.

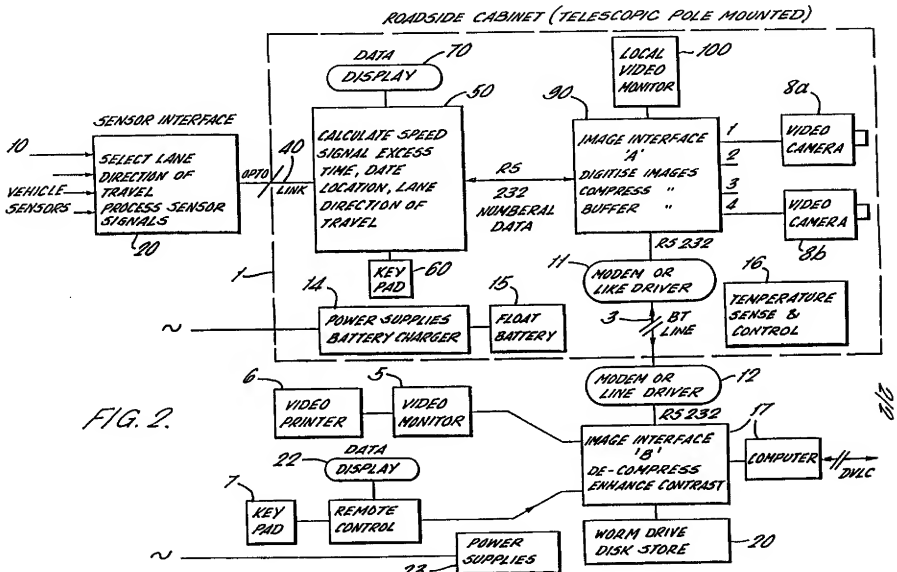
ROADSIDE CABINET (TELESCOPIC POLE MOUNTED)
SENSOR INTERFACE
10
SELECT LANE DIRECTION OF TRAVEL PROCESS SENSOR SIGNALS
VEHICLE SENSORS
20
OPTO
40
LINK
DATA DISPLAY
70
CALCULATE SPEED SIGNAL EXCESS TIME, DATE LOCATION, LANE DIRECTION OF TRAVEL
50
RS 232 NUMBERAL DATA
LOCAL VIDEO MONITOR
100
90
IMAGE INTERFACE 'A'
DIGITISE IMAGES
COMPRESS "
BUFFER "
8a
VIDEO CAMERA
VIDEO CAMERA
8b
1
2
3
4
RS 232
11
MODEM OR LIKE DRIVER
3
BT LINE
16
TEMPERATURE SENSE & CONTROL
KEY PAD
60
14
POWER SUPPLIES BATTERY CHARGER
15
FLOAT BATTERY
6
VIDEO PRINTER
5
VIDEO MONITOR
MODEM OR LINE DRIVER
12
RS 232
17
IMAGE INTERFACE 'B'
DE-COMPRESS ENHANCE CONTRAST
COMPUTER
DVLC
DATA DISPLAY
22
7
KEY PAD
REMOTE CONTROL
WORM DRIVE DISK STORE
20
POWER SUPPLIES
23

FIG. 2.

VEHICLE MONITORING APPARATUS

The present invention relates to vehicle monitoring apparatus and in particular to vehicle monitoring apparatus which provides an image of a vehicle.

The monitoring of road traffic is commonplace. Such monitoring is required in order to enforce traffic regulations.

In one aspect the present invention provides vehicle monitoring apparatus comprising vehicle detection means to detect the presence of a vehicle and provide a signal under predetermined conditions, a first video means operative to provide a telephoto image of said vehicle in response to said signal, and a second video means operative to provide a wide angle image of said vehicle and its surroundings in response to said signal.

Preferably, the first and second video means comprise respective first and second video cameras, wherein said video cameras have different focal lengths to provide said images of said vehicle.

The vehicle monitoring apparatus preferably includes a remote monitoring station, and communication means operative to transmit said images from said first and second video means to said remote monitoring stations.

In a second aspect of the present invention vehicle monitoring apparatus comprises vehicle detection means to detect the presence of a vehicle and provide a signal under predetermined conditions; video means to provide an image of said vehicle in response to said signal; a remote monitoring station; and communication means operative to transmit said image to said remote monitoring station.

Preferably image processing means are provided to digitise the images before transmission, and memory means are provided to hold the digitised images.

To reduce the amount of data transmitted, the image processing means preferably includes compression means to compress the digitised images before transmission.

The communication means providing a link between the video camera and the remote monitoring station can be a modem communicating over a telephone line or a radio link.

Preferably the remote monitoring station is operative to receive the images and at least one of display print and record the images.

Further, the remote monitoring station is preferably capable of controlling the video cameras and the vehicle detection means via the telephone line or radio link.

Preferably the monitoring station is capable of communicating with several video cameras and vehicle detection means provided at different locations. Thus an operator at the remote monitoring station can monitor several different locations and control the video cameras at these locations.

Preferably the remote monitoring station includes central processing means and the central processing means includes decompression means to decompress the received compressed images.

In one embodiment of the present invention the central processing means is adapted to be linked to a database containing information on vehicles to be detected.

In another embodiment, the vehicle detection means is operative to detect the presence of a vehicle at a location past traffic control means at which said vehicle should have halted.

In a further embodiment, the vehicle detection means includes data processing means operative to calculate

the speed of a vehicle and provide a signal only if a predetermined threshold speed is exceeded.

Where first and second video cameras are used, in one embodiment they are operative to provide the images separated by a predetermined time period, which enables a calculation of the speed of the vehicle to be made using the images.

In a preferred embodiment alphanumeric data is superimposed on the images. The alphanumeric data can comprise at least one of speed, time, date, location and direction of travel.

In another embodiment of the present invention which uses two video cameras, the first and second video cameras are operative to provide the images simultaneously.

Thus the present invention provides for the remote monitoring of, for instance roads, using remotely controlled video cameras. A single image or pair of images from a pair of video cameras is obtained digitally using a frame grabbing technique which is triggered by the detection of the presence of a vehicle to be imaged.

The provision in one aspect of the present invention of a first and second video means providing respectively a telephoto and wide angle image of the vehicle allows for the use of cheap and low resolution video cameras. High resolution is only required to identify for instance the number plate of a vehicle passing the monitoring apparatus. This information is provided in the telephoto image whereas the wide angle image provides information on the location of the vehicle. If the two images provided by the two video cameras are taken at different times, then with knowledge of the time period separating the two images, the speed of the vehicle being monitored can be calculated.

An example of the present invention will now be described with reference to the drawings, in which:

Figure 1 is an illustration of the vehicle monitoring apparatus located at the roadside with a remote monitoring station according to one embodiment of the present invention;

Figure 2 is a schematic diagram of the construction of the vehicle monitoring apparatus according to one embodiment of the present invention;

Referring now to Figure 1, this diagram illustrates one application of the present invention. A roadside cabinet 1 is placed in the central reservation of a dual carriageway. The presence of vehicles on the road can be detected by vehicle detection means which preferable comprises detectors in slots in the road surface about 20 metres from the roadside cabinet 1. Any convenient means for detecting the presence of a vehicle can be used and alternatively light beams could be used for example. The roadside cabinet 1 is linked via communication means to a remote monitoring station. In the illustration of Figure 1 the communication means comprises a telecommunication link 3. At the remote monitoring station 4, a processor is provided together with a monitor 5, printer 6 and keypad 7. Thus images being transmitted from the roadside cabinet can be displayed, printed or stored on for instance a worm drive disk store.

In the illustration of Figure 1 the vehicle detection means 2 comprises detectors in two slots in the road which enable the speed of the vehicle to be calculated. If a predetermined speed limit is exceeded by a vehicle passing the vehicle detection means 2, then a video camera within the roadside cabinet 1 captures an image of the vehicle. The signal from the vehicle detection means 2 triggers not only a calculation of the speed of the vehicle, but also the opening of the video

camera shutter to start recording. An image of the vehicle is digitised and overlaid with alphanumeric data such as speed, time, date, location, lane, and direction of motion. The digitised video image is then compressed and stored in a buffer memory ready for subsequent transmission via a telephone line to the remote monitoring station 4.

A number of roadside locations can be controlled from a single remote monitoring station 4. The operator being able to select the site under observation from the control desk. In addition, the operator can switch lanes at a particular site, transmit a test signal at any site and switch on or off any camera from the control desk. The composite data arriving at the control desk can be viewed on a monitor, stored for future analysis and/or printed out as a hard copy by means of a video printer.

The roadside cabinet 1 can house two video cameras, one having a higher magnification lens than the other. In this arrangement two images are provided of a vehicle exceeding a predetermined speed limit past the vehicle detection means 2. One image is a telephoto image giving a closer view of the vehicle, whilst the other is a wide angle image providing a image not only of the vehicle but also the surrounding location. These two images can easily be taken simultaneously or at a predetermined distance apart in time. If the two images are taken at a predetermined distance apart in time then it is possible from the difference in position of the vehicle in the two images to calculate the speed of the vehicle. Thus using this method a second calculation of the speed of the vehicle is provided to supplement that provided by the vehicle detection means 2. The two calculated speeds can be compared thus eliminating any possibility of error.

The purpose of providing a telephoto image of the vehicle in addition to the wide angle image which includes

the vehicle surroundings, is to enable identification of the vehicle using the registration number plate. Normal video cameras provide images of insufficient resolution to be able to resolve the registration number plate when an image is taken of the vehicle and its surroundings. It is not however insufficient for legal evidence to prove violation of traffic regulations to merely provide an image of a vehicle without its surroundings. The provision of the telephoto image and the wide angle image overcomes this problem.

In conditions of low ambient light intensity, the roadside cabinet 1 can be provided with an illuminating source if required. This could be a continuous infrared source for example.

The most convenient method providing communication between the roadside cabinet 1 and the remote monitoring station 4 is using serial data via a telephone line and modems. Data compression and decompression can be used to reduce the volume of data to be transmitted and stored.

Figure 2 is a schematic illustration of the construction of the vehicle monitoring apparatus according to one embodiment of the present invention. Vehicle detection means comprises vehicle sensors 10 which provide inputs to a sensor interface 20. This selects the lane on the road on which vehicles are being detected and processes the sensor signals. The sensor signals are then passed into the roadside cabinet 1 via an optolink 40. Within the roadside cabinet 1 data processing means 50 is provided to calculate the speed and output a signal if the speed exceeds a predetermined memorised threshold. The predetermined threshold speed can be set using the keypad 60. The keypad 60 can also be used to input such data as time, date, location, lane and direction of travel. This can be displayed on a data display 70.

When the predetermined threshold speed is exceeded, a signal is sent via an RS232 link to the image processing means 90 to capture a frame from the video cameras 8a and 8b. Within the image processor 90, the video frames from the video cameras 8a and 8b are digitised and compressed before being stored in a buffer memory. A local video monitor 100 can be provided within the roadside cabinet for local monitoring of the images.

The data processing means 50 can also superimpose alphanumeric data on the image as shown in Figure 1. The alphanumeric data can be for instance the calculated speed, time, date, location, lane, and direction of travel.

Communication means is provided for communication to a remote control station in the form of an RS232 link from the image processor 90 to a modem or line driver 11. The modem or line driver 11 is then linked to a modem or line driver 12 in the remote monitoring station by a telephone line 3.

The roadside cabinet 1 is also provided with both a mains power supply 14 and a battery 15. The mains power supply 14 also includes a battery charger to maintain the charge of the battery 15.

The roadside cabinet 1 also includes temperature sensing and control circuitry 16 to provide automatic cut-out if the temperature range exceeds or falls below specified temperatures.

At the remote monitoring station 4 there is provided a modem or line driver 12 linked to the roadside cabinet by the telephone line 3. The modem or line driver 12 is linked to a central processor 17 via an RS232 link. The central processor 17 decompresses the received compressed digitised image and can enhance the contrast. The central processor 17 is provided with a video monitor 5 and a video printer 6. There is also provided a worm drive disk store

20 interfaced to the central processor 17 to provide for storage of the received images. Control of the arrangement in the roadside cabinet 1 can be provided by inputting control commands using the keypad 7 which is also provided with a data display 22. These are connected to the central processor 17 via an RS232 link.

The video cameras 8a and 8b can be switched on or off from the remote monitoring station 4 and the lane on the road being monitored can also be changed.

The central processor 17 can be linked to a database such as that of the DVLC in order to obtain information on vehicles being detected.

The remote monitoring station includes power supplies 23 for the circuitry.

Although the hereinabove described embodiment of the present invention has been described with reference to monitoring the speed of vehicles on a roadway, the present invention is equally applicable to the detection of vehicles illegally negotiating traffic lights. For vehicles "jumping" the red lights, vehicle detection means can detect the presence of a vehicle at a position past the traffic lights, whereupon a video image is captured and digitised by the video cameras. Either a single video image from a single video camera or a telephoto image and a wide angle image from two video cameras can be taken. Using the two video images taken at different times, it is possible not only to detect that a vehicle has "jumped" the red light, but also to detect using the images the speed at which the vehicle negotiated the traffic lights. This information is immediately available to the operator in the remote monitoring station. Thus this information can be acted upon quickly if desired.

When taking a telephoto image together with a wide angle image, the time interval between the images would be

determined by use of a field counter which increments every 20ms. If the interval was chosen to be 20ms x 10 = 200ms ≈ 1ms then a vehicle would have travelled about 12 feet at 40 mph or about 24 feet at 80 mph. The interval must be chosen to be long enough to facilitate scaling of the images but not so long as to involve vehicles closely following the offending vehicle.

The present invention can thus provide for remote monitoring of vehicles using video cameras of low resolution. The cost penalty of using a second camera is not such as to be a major disadvantage when the total system cost is considered.

CLAIMS

1. Vehicle monitoring apparatus comprising vehicle detection means to detect the presence of a vehicle and provide a signal under predetermined conditions, a first video means operative to provide a telephoto image of said vehicle in response to said signal, and a second video means operative to provide a wide angle image of said vehicle and its surroundings in response to said signal.

2. Vehicle monitoring apparatus as claimed in Claim 1, wherein said first and second video means comprise respective first and second video cameras, said video cameras having different focal lengths to provide said images of said vehicle.

3. Vehicle monitoring apparatus as claimed in Claim 1 or Claim 2 including a remote monitoring station, and communication means operative to transmit said images from said first and second video means to said remote monitoring station.

4. Vehicle monitoring apparatus as claimed in Claim 3 including image processing means to digitise said images before transmission, and memory means to hold said digitised images.

5. Vehicle monitoring apparatus as claimed in Claim 4 wherein said image processing means includes compression means to compress the digitised images before transmission.

6. Vehicle monitoring apparatus as claimed in Claim 4 or Claim 5, wherein said communication means includes a modem operative to communicate with said remote monitoring

station using a telephone line.

7. Vehicle monitoring apparatus as claimed in any of Claims 3 to 6, wherein said remote monitoring station is operative to receive said images, said images being at least one of displayed, printed and recorded.

8. Vehicle monitoring apparatus as claimed in any of Claims 3 to 7, wherein said remote monitoring station is operative to control said first and second video means, and said vehicle detection means using said communication means.

9. Vehicle monitoring apparatus as claimed in any of Claims 3 to 8 including a plurality of said vehicle detection means and associated first and second video means provided at different locations, said communication means being operative to transmit the images from each said first and second video means to said remote monitoring station.

10. Vehicle monitoring apparatus as claimed in Claim 4, wherein said remote monitoring station includes central processing means.

11. Vehicle monitoring apparatus as claimed in Claims 5 and 10, wherein said central processing means includes decompression means to decompress the received compressed images.

12. Vehicle monitoring apparatus as claimed in Claim 10 or Claim 11, wherein said central processing means is adapted to be linked to a database containing information on vehicles that have been detected.

13. Vehicle monitoring apparatus as claimed in any preceding claim, wherein said vehicle detection means is operative to detect the presence of a vehicle at a location past traffic control means at which said vehicle should have halted.

14. Vehicle monitoring apparatus as claimed in any of Claims 1 to 12, wherein said vehicle detection means includes data processing means operative to calculate the speed of a vehicle and provide a signal only if a predetermined threshold speed is exceeded.

15. Vehicle monitoring apparatus as claimed in Claim 13 or Claim 14, wherein said first and second video means are operative to provide said images separated by a predetermined time period; wherein the speed of the vehicle can be calculated using said images.

16. Vehicle monitoring apparatus as claimed in any preceding claim including means to superimpose alphanumeric data on said images.

17. Vehicle monitoring apparatus as claimed in Claim 16, wherein said alphanumeric data comprises at least one of speed, time, date, location and direction of travel.

18. Vehicle monitoring apparatus as claimed in any of Claims 1 to 14, 16 or 17, wherein said first and second video means are operative to provide said images simultaneously.

19. Vehicle monitoring apparatus comprising vehicle detection means to detect the presence of a vehicle and provide a signal under predetermined conditions; video

means to provide an image of said vehicle in response to said signal; a remote monitoring station; and communication means operative to transmit said image to said remote monitoring station.

20. Vehicle monitoring apparatus as claimed in Claim 19 including digitisng means to digitse said image from said video means, and memory means to hold the digitised image.

21. Vehicle monitoring apparatus as claimed in Claim 20, wherein said communication means includes a modem operative to communicate with said remote monitoring station using a telephone line.

22. Vehicle monitoring apparatus as claimed in Claim 3 or Claim 19, wherein said communication means includes a radio link between said video means and said remote monitoring station.

23. Vehicle monitoring apparatus as claimed in Claim 20 or Claim 21, wherein said image processing means includes compression means to compress the digitised images before transmission.

24. Vehicle monitoring apparatus as claimed in any of Claims 19 to 21, or 23, wherein said remote monitoring station is operative to receive said images, said images being at least one of displayed, printed, and recorded.

25. Vehicle monitoring apparatus as claimed in any of Claims 19 to 21, 23 or 24 including a plurality of vehicle detection means and associated video means provided at different locations, said communication means being operative to transmit images from said video means to said

remote monitoring station.

26. Vehicle monitoring apparatus as claimed in Claim 20, wherein said remote monitoring station includes central processing means.

27. Vehicle monitoring apparatus as claimed in Claim 20 and 23, wherein said central processing means includes decompression means to decompress the received compressed image.

28. A vehicle monitoring apparatus as claimed in Claims 26 or 27, wherein said central processing means is adapted to be linked to a database containing information on vehicles that have been detected.

29. Vehicle monitoring apparatus as claimed in any of Claims 19 to 28, wherein said vehicle detection means is operative to detect the presence of a vehicle at a location past traffic control means at which said vehicle should have halted.

30. Vehicle monitoring apparatus as claimed in any of Claims 19 to 28, wherein said vehicle detection means includes data processing means operative to calculate the speed of a vehicle and provide a signal only if a predetermined threshold speed is exceeded.

31. Vehicle monitoring apparatus as claimed in new Claims 19 to 30 including means to superimpose alphanumeric data on said images.

32. Vehicle monitoring apparatus as claimed in Claim 31, wherein said alphanumeric data comprises at least one of speed, time, date, location, and direction of travel.

33. Vehicle monitoring apparatus substantially as hereinbefore described with reference to any of the drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
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Relevant Technical fields

(i) UK Cl (Edition K) G4Q (QCC, QCB, QCF, QCJ)

5 G08G

(ii) Int Cl (Edition)

Search Examiner
M J DAVIS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search
17 SEPTEMBER 1992

Documents considered relevant following a search in respect of claims 1,33 & CLAIMS APPENDANT

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 1560119 (OLESEN) whole document, especially page 2 lines 16-23	

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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